PRELIMINARY RESEARCH PROPOSAL (COE) (FY05)

TITLE: Evaluation of juvenile salmonid condition in McNary Dam gatewells equipped with prototype vertical barrier screens under various turbine operating conditions

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PROJECT DURATION: FY2004-06

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PROJECT SUMMARY

This study will provide fish condition estimates for PIT-tagged adipose-fin-clipped yearling and subyearling Chinook salmon *Oncorhynchus tshawytscha*, sockeye salmon *O. nerka*, and steelhead *O. mykiss* released into turbine intakes and gatewells equipped with a prototype vertical barrier screen (VBS) under different operating conditions at McNary Dam. We will PIT tag (Prentice, et al. 1990) river-run salmon smolts at McNary Dam. Releases will be equally divided between selected release locations. Fish will be recaptured and examined using the

separation-by-code (SbyC) capabilities of the McNary Dam juvenile fish facility. Recaptured fish will be evaluated using standard Fish Transportation Oversight Team (FTOT) criteria.

RELEVANCE

Survival of juvenile salmonids that pass through turbines of hydroelectric projects on the Columbia River has long been lower than desired. While other passage routes such as spillways and bypass systems typically result in higher survivals for juvenile salmonids, improving turbine survival can offer great benefits, especially in low flow years such as 2001. Studies at McNary Dam in 2002 (Normandeau et al. 2003) indicated that juvenile salmonid survival may not be significantly different over a range of turbine discharges. Higher turbine discharges may require modifications to the gatewell bypass system components to minimize any potential impact to juvenile salmonids exposed to more turbulent gatewell conditions. This study addresses that by evaluating the gatewell environment to identify components which may have a detrimental effect on fish condition, including a newly designed VBS. Furthermore, results from studies conducted in 2004 suggested that increases in descaling and injury rates measured during higher turbine discharges may not have been related to gatewell conditions. Therefore, additional release locations will be evaluated in 2005 to isolate where descaling may be occurring prior to fish entering the gatewells.

This proposal addresses Action Items 58, and 59 of the NMFS 2000 Biological Opinion for Operation of the Federal Columbia River Power System (NMFS 2000), and element OTS-W-04-1 of the U. S. Army Corps of Engineers (COE) Anadromous Fish Evaluation Program. This study also addresses Question 3 of the Ten Key Questions for Salmon Recovery in the NMFS Salmon Research Plan (NMFS 2002).

STUDY OBJECTIVES

We propose to evaluate the condition of yearling and subyearling chinook salmon, sockeye salmon, and steelhead released in locations prior to entering the gatewell slot and into gatewells with prototype and current design VBSs at McNary Dam at high discharge levels.

PROJECT DESCRIPTION

Objective: Determine where increases in descaling and injury are occurring to yearling and subyearling Chinook salmon, sockeye salmon, and steelhead prior to entry into gatewells of turbines operating at high discharge levels at McNary Dam.

Results for studies conducted in 2004 suggested that descaling and injury may be occurring prior to fish entering gatewells of turbines operating at high discharge levels at McNary Dam. To isolate where the increases may be occurring, we propose to release fish in 3 locations: 1) in front of the trash racks, 2) in front of the guidance device, and 3) in the gatewell as deep as possible to minimize chances of conflict with other gear and equipment. A single turbine unit at McNary Dam (yet to be determined) will be equipped with prototype VBSs and fitted with necessary release equipment.

To conduct this work, we may have to adjust past or develop new release procedures in order to place fish in the selected areas. Once our release strategies are solidified, we will provide more details on study design. Gatewell releases will be accomplished using a release canister (Absolon and Brege 2003) as was done in 2004.

Run-of-river fish will be collected by dipnetting gatewells at McNary Dam. Pre-anesthesia and water-to-water transfer will be used to minimize impact to handled fish. Fish will be collected

and PIT tagged in the evening and held overnight to monitor release groups for tagging mortality. Releases will be made in the morning in an attempt to minimize the number of juvenile salmonids diverted with the target PIT-tagged fish at the SbyC system. PIT-tagged fish recaptured with the SbyC system will be anesthetized and examined for signs of descaling and injury. After recovery from anesthesia, fish will be released to the river. Recaptured PIT-tagged fish will also be collected from the smolt monitoring sampling effort.

Because the release locations and number of release groups has not been determined, we are basing our estimates on 5 release groups in 3 locations. To detect a 2% difference in descaling between release groups and assuming a 90% re-examination rate, 5 replicates of 170 fish per replicate for each of the 5 release groups would be required for a total of roughly 5,000 PIT-tagged fish per species.

Results from 2004 indicate that the 90% passage time for gatewell-released fish to be detected at the full-flow PIT-tag detectors is about two days, which necessitates a two-day block design in the operation of the test unit. Due to the every-other-day operation of the juvenile fish facility at McNary Dam and the two day block design of the unit operation, it is only possible to release fish once every four days. This limits the number of study replicates that can be conducted during the outmigration. This, in turn, also limits the number of species that can fully evaluated.

In spring, we anticipate concentrating our effort on yearling chinook salmon, while conducting as many replicates as practical with sockeye salmon and steelhead. Evaluations will begin as soon as sufficient numbers of test fish are available, which is typically near the end of April.

We anticipate repeating the evaluation with subyearling chinook salmon during the June - July period. Adjustments to release locations may be made based on results from spring testing. Adjustments to the number of fish per release will also be evaluated. During the "summer-like-condition" operation of the juvenile fish facility, it is not possible to use the "B" side of the SbyC system to recollect PIT-tagged fish as the juvenile fish facility is currently constructed. This is due to the necessity to use what would be a common flume during periods of barge loading. Use of only the "A" side of the SbyC system reduced the percentage of recollected fish by about half. Adjustments to the number of tagged fish and/or the number of replicates will be made as necessary to maintain the study's precision.

CRITICAL LIMITATIONS

The ultimate success of this project will be contingent upon three primary factors: 1) whether adequate numbers of fish can be collected and PIT tagged at McNary Dam during the required time frame, 2) whether the pre-determined replicates and sample sizes will provide the necessary precision study precision, and 3) whether PIT-tag detectors and S-by-C systems at McNary Dam will be available and operational for the duration of the study.

PROJECT IMPACTS

1. Fish handling and storage conexes will required on the McNary Dam intake deck from approximately 1 April through 31 August 2005.
2. Dipnetting with mobile cranes for fish collection and canister releases will block access across the powerhouse for short periods of time during the study period.

3. Submersible pumps will be in place from 1 April to approximately 15 July 2005.
4. Turbine loading will have to remain constant at the selected loading for 24 - 48 hours during fish releases.
5. Collection, tagging, and fish-holding operations at McNary Dam during April through July will be coordinated with the Project Office and Smolt Monitoring Program personnel.
6. Activities related to marking and releasing fish may occur during all hours; therefore, unusual vehicle traffic and activity may occur outside normal COE duty hours during April through July.

PERMIT REQUIREMENTS

These studies will be carried out under an ESA Section 10 Permit issued to NOAA Fisheries and under any necessary state permits.

TECHNOLOGY TRANSFER

Information acquired during the proposed work will be transferred to the fisheries community by presentations at meetings and workshops, by personal contact, by annual and final reports to the U.S. Army Corps of Engineers, and through scientific publications.

KEY PERSONNEL AND DUTIES

Randall F. Absolon	Co-Principal Investigator
Michael H. Gessel	Co-Principal Investigator
Dean Brege	Co-Principal Investigator
Thomas E. Ruehle	Field Coordinator

Steven G. Smith Statistician
Benjamin P. Sandford Statistician

REFERENCES

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